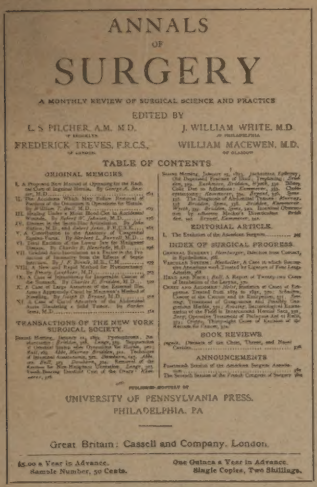
REPRINTED FROM


ANNALS
OF
SURGERY
A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE
EDITED BY
L. S. PILCHER, A.M., M.D. — J. WILLIAM WHITE, M.D.
FREDERICK TREVES, F.R.C.S. — WILLIAM MACEWEN, M.D.
TABLE OF CONTENTS
ORIGINAL MEMOIRS
EDITORIAL ARTICLE.
INDEX OF SURGICAL PROGRESS.
BOOK REVIEWS.
ANNOUNCEMENTS
TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.
UNIVERSITY OF PENNSYLVANIA PRESS.
PHILADELPHIA, PA.
Great Britain: Cassell and Company, London.
$5.00 a Year in Advance. Sample Number, 50 Cents.
One Guinea a Year in Advance. Single Copies, Two Shillings.

NOVEMBER, 1897

A New Method for the Radical Cure of Inguinal Hernia: Intraperitoneal Transplacement of the Spermatic Cord and Typical Obliteration of the Internal Ring and Inguinal Canal.

By GEORGE RYERSON FOWLER, M.D.,

OF BROOKLYN,

Professor of Surgery, New York Polyclinic; Surgeon to the Methodist Episcopal and to the Brooklyn Hospitals.

A NEW METHOD FOR THE RADICAL CURE OF INGUINAL HERNIA: INTRAPERITONEAL TRANSPLACEMENT OF THE SPERMATIC CORD AND TYPICAL OBLITERATION OF THE INTERNAL RING AND INGUINAL CANAL.[1]

By GEORGE RYERSON FOWLER, M.D.,

OF BROOKLYN,

PROFESSOR OF SURGERY, NEW YORK POLYCLINIC; SURGEON TO THE METHODIST EPISCOPAL AND TO THE BROOKLYN HOSPITALS.

The dangers and inconveniences to which persons the subject of hernia are constantly subjected have led surgeons to devise operative procedures for the radical cure of this condition. In inguinal hernia the earliest attempts in this direction consisted of the removal of the corresponding spermatic cord and testicle, it being recognized that the presence of the former in the inguinal canal constituted the chief source of menace of a recurrence of the protrusion. A natural desire to avoid the mutilation inseparable from this method of cure, however, finally led to its practical abandonment, and no effort seems to have been made to follow out the indications embraced in the operation of castration without actually resorting to the latter until the publication of the work of Bassini in 1884.[1]

The efforts of Bassini were directed to the removal of the spermatic cord from the inguinal canal proper, and, in addition, to the restoration of the normal physiologic conditions of the course which the cord should pursue in its new situation. His aim was to place the cord in a canal with two openings, an abdominal and a subcutaneous one, and two

[1] Presented at the Twelfth International Medical Congress, Moscow, August 24, 1897.

walls, an anterior and a posterior one. Along the new canal the cord was designed to pass in an oblique direction, corresponding to the original inguinal groove, to the scrotum. In his original description of the operation the aponeurosis of the external oblique is described as being incised from the external ring to a point above the internal ring, and loosened above and below. The spermatic cord and hernial sac are elevated *in toto* and separated from each other and from the surroundings by blunt dissection. After emptying the sac and isolating the latter the neck is tied off and the hernial sac cut away about half a centimetre in front of the ligature; the cord is held out of the way, and a new posterior wall formed upon which the cord is to rest in its new situation, by suturing together all of the structures from behind forward until the aponeurosis of the external oblique is reached. The spermatic cord is now laid upon the line of suturing which closes the formerly existing inguinal canal, and the aponeurosis of the external oblique made to cover the cord, its incised edges being united by sutures. By this procedure the aponeurosis of the external oblique is made to form the anterior wall of the newly formed inguinal canal. The skin edges of the incision are finally sutured. Catgut is employed for the deep sutures.

Postempski[2] modified this procedure by including the aponeurosis of the external oblique in the layer sutures, thus completely obliterating the inguinal canal. He then places the cord in front of the aponeurosis of the external oblique and towards the median line.

Halsted, who employed his method before the publication of either Bassini's or Postempski's operation, dissects the larger veins from the cord in order to reduce its bulk and places the latter in front of the aponeurosis and towards the outer side, or Poupart's ligament. In addition to this, Halsted, instead of ligating the sac, cuts the latter away and closes the opening as a laparotomy wound.

The object aimed at in all three of these operations is essentially the same,—namely, to accomplish the obliteration

of the inguinal canal and to provide a new route for the spermatic cord to reach its final destination in the scrotum.

Although the features of these procedures are well known to surgeons of the present day, for the reason that the operation of Bassini and its modifications has practically superseded all others, in this country at least, I have been particular to call attention to them in order to emphasize the weak points in these methods, and to point out a simple and to my mind an efficient way of overcoming them.

In Bassini's and Postempski's operations the neck of the sac is ligated at the internal ring, leaving the former *in situ* with its funnel-shaped dimple and finally more or less decided infundibulum, presenting upon the peritoneal surface. (Dia-

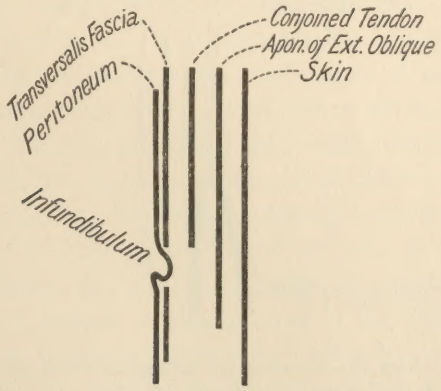


DIAGRAM A.—Showing the infundibulum.

gram A.) The general direction of this infundibulum is either forward, forward and downward, or forward, downward, and obliquely inward (medianward) in the general direction of the inguinal canal. The first named of these directions (forward) is the least mischievous of the three directions which the infundibulum may assume in this method of dealing with the neck of the sac, and the last named (forward, downward, and medianward) is the most harmful,—yet all of them directly and absolutely invite a recurrence of the hernia, as does its analogue, the depression which occurs at the site of the

internal ring following the completion of the descent of the testicle. (Diagram B.) The length of time which this takes will depend upon the support which the external structures give to the infundibulum at this point, the amount of intra-abdominal pressure, and the freedom of movements of the intestinal coils as governed by the length of the mesentery. Once, however, the depression upon the peritoneal surface becomes sufficiently marked to embarrass the convexly shaped surface of intestine in its movements at this point, the insidious and constantly exercised force from within the ab-

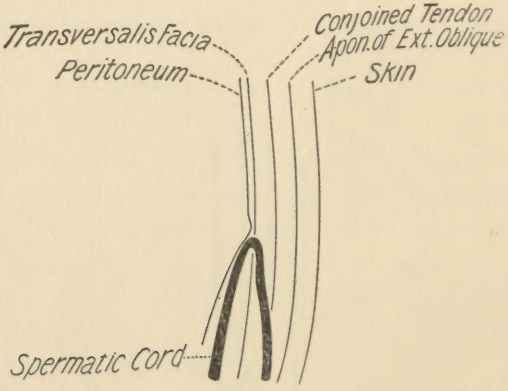


DIAGRAM B.—Showing the depression which occurs at the site of the internal ring, following the completion of the descent of the testicle.

domen exerted through this as a wedge, aided by peristalsis and the movements of the intestinal contents, and finally by gravity as the depression becomes more pronounced; with all these predisposing factors brought into play from the peritoneal side of the abdominal wall, there is but one thing lacking to complete the probability of the return of the hernia,—namely, an absence of support from without. This is furnished by the still-existing internal ring, the point at which the hernia, if an indirect one, protruded originally, and which the presence of the cord as it passes forward through the mus-

cular structures of the abdominal wall renders necessary, and the relaxed transversalis fascia at the site of Hesselbach's triangle, if the hernia has been a direct one. The smaller the cord the more contracted the ring, and hence the less the invitation for the passage of new hernial sac along-side the cord and through the ring. These well-known facts furnish an explanation for the comparatively successful application of the Bassini method in children, as shown by Coley's statistics. In addition to this, it is a well-known fact that almost any operative procedure that includes ligation of the neck of the sac close down to the internal ring, and approximation of the pillars of the canal will suffice, in the great majority of cases, for the cure of inguinal hernia in children. The crucial test of the merits of any operation for the radical cure of hernia, however, resides not in its applicability to a certain class of cases, and these of minor importance from our present stand-point, since these, the hernias of childhood, can and are quite frequently cured by simply wearing a truss; but in the success which follows its application to the hernias of adults, and particularly those of long standing, in which the entire posterior wall of the inguinal canal and, perhaps, the site of Hesselbach's triangle as well, is thrust forward, owing to loss of tone of the musculo-fascial structures, with, perhaps, pronounced atrophy of the latter.

The weak point relating to the gathering in of the circumference of the neck of the sac by a constricting ligature and the consequent formation of a dimple, the tendency of which is to finally enlarge into a decided infundibulum, not only pertains to the method of Bassini and its modifications, but to all those which include dealing with the neck of the sac by ligature, in the technique, as originally practised by Czerny, of Heidelberg.

The first important and decided modification of this defective method of dealing with the neck of the sac was made by Macewen in 1886, who separated the sac from the inguinal canal and from the circumference of the internal ring upon its abdominal aspect as well, and then reduced the sac into

the abdomen beyond the internal ring, where it is thrown into a series of folds. These folds constitute a pad or "boss" which takes the place of the infundibulum, formed where the neck of the sac is ligated external to or in front of the peritoneal level of the abdominal wall. The method is not easy of execution, and one cannot be certain, even when the steps have been accurately followed, as described by its originator, that the sac has been disposed of in the manner intended.

The next important modification of the older methods, and the first in which a systematic effort was made to so alter the primary direction of the sac as to minimize the tendency to relapse dependent upon the presence of the infundibulum, was that of Kocher, in 1892. The essential and characteristic feature of Kocher's operation consists in making a small opening in the external oblique above and external to the upper limit of the inguinal canal and drawing the detached sac through this opening. The anterior wall of the inguinal canal is not incised, nor is the cord displaced. Formerly Kocher twisted the bulk of the sac into a roll and sutured the latter over the site of the inguinal canal. More recently, however, he has abandoned this practice, and now directs the sac, after drawing it through the aponeurosis of the external oblique, outward towards the anterior superior iliac spine, and sutures it to the aponeurosis. Two deep sutures are placed, one between the upwardly displaced neck of the sac and the spermatic cord and the other above the sac. These penetrate deeply and include the entire thickness of the abdominal wall. The spermatic cord remains in the inguinal canal. The method is only applicable to hernias with considerable dilatation of the ring, and is excluded in pathologic alterations of the hernial sac, inflammatory conditions, the presence of adherent intestine or omentum in the sac, and in strangulated hernia, in which it becomes necessary, in order to reach the constriction, to incise the anterior wall of the inguinal canal. Besides which, the success of efforts to approximate the pillars of the canal without incision of the aponeurosis of the external oblique by means of the deep

sutures alluded to, to say nothing of the attempt to diminish the size of the internal ring by the same means, must be highly problematical, to say the least. This is particularly true of the attempt to lessen the size of the internal ring, which is apparently the object of the suture applied between the upwardly displaced sac and the spermatic cord, to say nothing of the danger of wounding the vessels of the cord attending the effort to thus blindly suture the internal ring. The method of subfascial suturing, suggested by Ekehorn, in order to avoid incision of the aponeurosis of the external oblique, from fear of gangrene of this structure, while possibly more efficient than the canal sutures of Kocher, are correspondingly difficult of application, and do not avoid the risks of injury to the cord incident to the attempt to closely approximate the margins of the ring to this structure without freely exposing the parts involved.

No one will deny the great impetus given to the surgery of inguinal hernia by the suggestion made by Bassini of displacing the cord in such a manner as to remove it entirely from the inguinal canal. The principle as carried out by Bassini was not original with that surgeon, inasmuch as this found its first expression in the earlier operative procedures in the application of castration for the cure of hernia. Here the presence of the cord was recognized as a most undesirable feature of the environment, and this was met by the efficient though crude measure of removal of the cord from the inguinal canal, and, incidentally, of the testicle from the scrotum as well. The end sought, however, was the getting rid of the spermatic cord in the inguinal canal, and it was the effort to accomplish this without sacrificing so important an organ as the testicle that led Bassini's introduction of this, the essential and peculiar feature of the operation which bears his name.

The method of restoration of the normal anteriorly directed obliquity of the inguinal canal and spermatic cord, as introduced by Marcy, of Boston, is worthy of note in this connection, for, although this surgeon did not attempt to

remove the cord from the spermatic canal, a most earnest and well-directed attempt was made to second these efforts made by Nature to compensate for the anatomical deficiencies in this neighborhood made necessary by the descent of the testicle, as well as to restore those safeguards originally designed to prevent the occurrence of hernia. Marcy's operation antedates that of Bassini, and, like the latter, finds its most favorable field of application in cases of children, and in comparatively recent and small hernias of adults. The method of broad approximation of opposing surfaces by continuous through-and-through suturing, as exemplified by Marcy's "cobbler's stitch," as well as the interrupted or "mattrass suture" of Halsted, constitute valuable features of the hernia operations of these surgeons, and have contributed not a little to the success of their procedures.

In order to secure to the utmost the advantages offered by the alteration of the primary direction of the cord afforded by Bassini's procedure, I devised a modification of this operation, which consisted in carrying the cord directly through the aponeurosis after the manner of Halsted and Postempski, and thereafter leading it in an upward direction to a point above the internal ring, after which it was allowed to pursue a course parallel with the line of sutures which closed the inguinal canal, to its final destination to join the testicle in the scrotum. The part of the cord which was thus elevated was secured in position by sutures of catgut. It was discovered that the supposed advantages of this manœuvre were lost in the course of time, the weight of the testicle dragging upon the cord until the latter finally pursued the direct course which it follows in the Bassini, Postempski, and Halsted operations. Later on a further modification was made, in which it was sought to overcome the tendency of the cord to pursue a straight course from its point of emergence upon the aponeurosis of the external oblique, and at the same time make a more favorable disposition of the hernial sac than that formerly followed when it was ligated at its neck and cut away. It occurred to me to follow the indication of pre-

venting the dimpling of the sac by directing the latter upward immediately after leaving the internal ring, the manner of accomplishing this being suggested by the ingenious method of dealing with the sac introduced by Kocher. With this in view a point about an inch above the margin of the internal ring was selected, and a slender forceps forced bluntly through the aponeurosis of the external oblique, the internal oblique, and the transversalis muscle. The point of the index-finger was now forced up between the transversalis fascia and the transversalis muscle and made to serve as a guide for the forceps, which latter, after perforating the structures named, is pushed obliquely downward and medianward until its point emerges opposite the internal ring. The jaws of the forceps were then opened, the distal portion of the sac grasped, and the forceps withdrawn, carrying the sac along with it. The sac, after emerging from the small opening in the structures above the ring made by the passage of the forceps, was drawn taut in an upward direction, passed beneath the spermatic cord, and reflected upon itself, so as to form a suspension loop for the latter and compel the cord to assume and maintain an upward direction in its primary course after leaving the ring. The sac, now converted into a flat ribbon-shaped loop, was sutured with kangaroo tendon or chromicized catgut upon itself and the aponeurosis of the external oblique, sufficient room for the cord being left to permit the latter to play freely in its new position. The cord was then allowed to rest upon the aponeurosis of the external oblique and towards the median line, as in Postempski's operation, and there secured by two or three sutures of catgut.

The objects sought by this modification—namely, a more favorable primary direction of the sac and cord—were attained. Experience with this method, however, developed the fact that the spermatic cord, in a not inconsiderable number of cases, was too short to permit of this looping up or suspension procedure to an extent necessary to secure its fullest benefits, without elevating the testicle to an extent to bring the latter organ in a position where it was exposed to

injury against the pubic bone. In addition to this that ever-present weak point in the abdominal wall, the *bête noire* of surgeons since the days when the cure of inguinal hernia by castration was interdicted by legal enactments,—namely, the internal abdominal ring,—was still a menace to the patient, and an inviting factor to the recurrence of the hernia. As a final criticism upon this method of suspension of the cord by means of the sac itself, I would call attention to the possibilities of creating a new place of exit for a direct hernia at the point where the sac is passed through the abdominal wall above the internal ring.

Although the method last described has never appeared in print, yet I feel impelled to dwell upon and criticise this procedure, for the reason that I have described it in my lectures to my classes; and, in addition, in a paper read before the New York Surgical Society in February last I called attention to the indications for this or some modification of the methods theretofore in use, and illustrated this procedure by means of drawings. While, without doubt, it combines the advantages of the Kocher and Bassini methods, it does not meet all the indications of an ideal operation for the radical cure of hernia, and presents some decided disadvantages of its own.

Attention has been recently called to some alleged disadvantages arising from incising the aponeurosis of the external oblique, the claim being made that this is materially weakened in its function of supporting the underlying muscular fibres by this feature of the Bassini operation, and that many of the failures are due to the occurrence of gangrene of this important structure. It was upon the basis of this that some advantages have been claimed for the Kocher method, and Ekehorn introduced his method of subfascial suturing in order to avoid incising this aponeurosis. It cannot be denied that, as a result of intra-abdominal pressure, there is a tendency on the part of the cicatricial line of union to gradually stretch. This is more likely to occur, however, if the muscular fibres have undergone those peculiar changes charac-

teristic of old herniæ, in which the abdominal wall has been subjected to long-continued pressure from within, and from truss-pressure, perhaps, in addition. As a result of these changes a stretching or bulging of the muscular wall occurs in the constantly widening gap between the cut edges of the aponeurosis. It is probably true that, under circumstances of considerable tension, even the most careful suturing may fail to approximate the incised edges of the aponeurosis sufficiently to procure definite union, in which case the bulging of the muscular wall will occur early in the subsequent history of the case, and increase rapidly. Further experience may show that, while many of the immediate post-operative failures are due to septic conditions leading to premature removal of the sutures, or their early disintegration, if these are of an absorbable character, a certain proportion of cases of so-called relapse are in reality instances of separation of the line of union of the aponeurosis, and are to be classed with the cases of ventral or surgical hernia. On the other hand, an actual recurrence of the hernia can only be said to be present when a hernial sac and its contents protrude through one or other of the hernial openings. Again, while it is probably true that gangrene of the edges of the aponeurosis, if it occurred, would lead to either immediate post-operative failure, ventral bulging, or even actual recurrence, it is none the less true that septic complications arising from errors in technique are far more likely to lead to sloughing of the incised edges of the aponeurosis than any inherent tendency, on the part of this structure, to become the seat of gangrene. One of the strongest arguments in favor of Kocher's operation is the immunity from failure in the face of complicating septic conditions, from the fact that whatever happens the strong aponeurosis remains intact. As already stated, however, in the opinion of the writer, the failure in this last-named procedure to so alter the primary direction of the cord as to remove this as a further menace to recurrence, as well as the omission of efficient measures to strengthen the weak portion of the abdominal wall at the

site of the internal ring and inguinal canal will prevent the adoption of this as an ideal operation.

As a result of some recent experiences in cases in which a direct hernia occurred in adults following the application of the essential feature of the Bassini operation,—namely, displacement of the cord directly forward through the opening in the transversalis fascia known as the internal abdominal ring, and the muscular parietes,—I have endeavored to develop an operation in which obliteration of the internal ring and inguinal canal would be complete and absolute. It became at once apparent that a radical departure from present methods was necessary in order to accomplish this. If the conditions obtained in castration could be brought about without actual sacrifice of the cord and testicle, it would seem as if the problem was solved. So long, however, as the cord passed primarily in a forward direction the opening in the transversalis fascia must needs exist, for the reason that it would be physically impossible to obliterate this, and at the same time permit the cord to occupy it.

Abandoning, therefore, all thought of anterior displacement of the cord, I turned my attention to its posterior displacement. Here but two courses were open to me. The first was to double the cord upon itself by incising the transversalis fascia from the internal ring, and, following the general direction of the inguinal canal or groove, placing the cord behind the fascia, and permitting it to emerge at the site of the external ring, afterwards suturing the transversalis fascia from the upper margin of the internal ring, including the latter in the suture line. Theoretically, this would accomplish what was aimed at,—namely, closure of the internal ring. Practically, however, it was found that the transversalis fascia in hernia cases was so markedly attenuated and relaxed below the ring that it was difficult of separation to a sufficient extent to form a definite layer for suturing. Besides, this method would not strengthen the posterior wall of the canal, a great desideratum in old cases, nor would it overcome the relaxed condition of the tissues

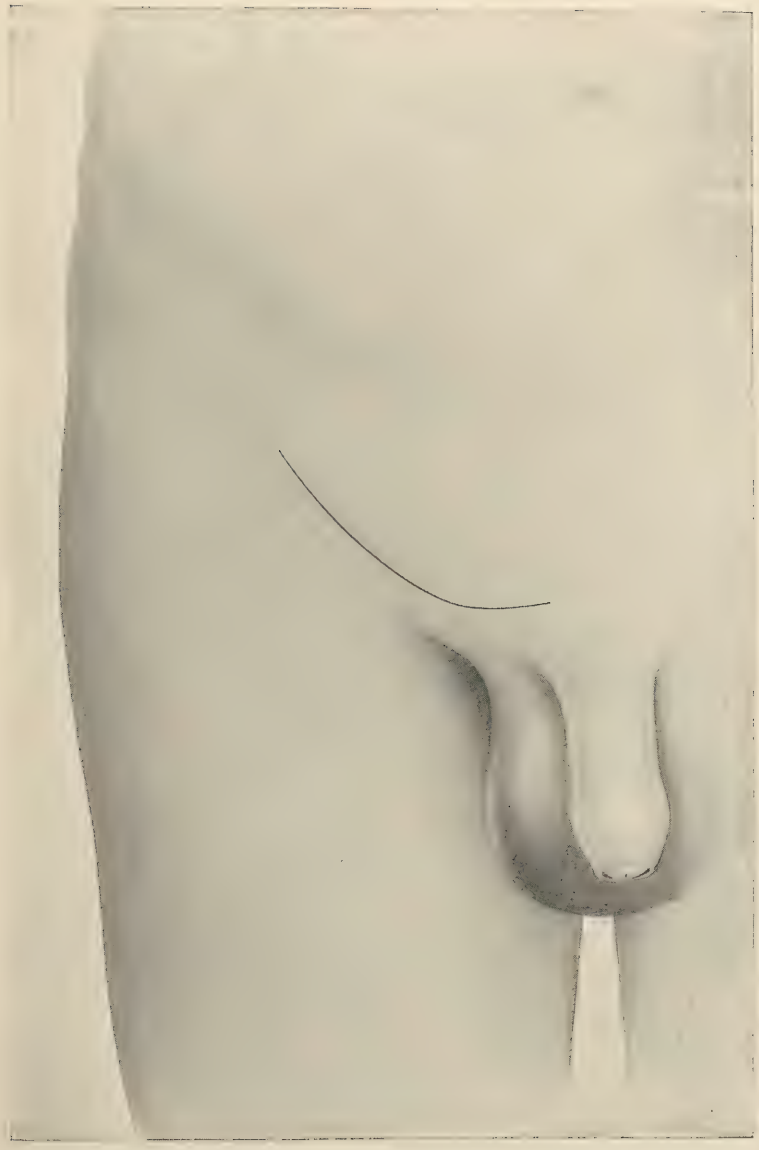


FIG. 1.—Incision from spine of pubis and parallel with Poupart's ligament to level of internal ring.

at the site of Hesselbach's triangle, a further object I had long had in view in devising an ideal operation for the radical cure of inguinal hernia of all varieties.

Following this line of reasoning, it was but a step further to the decision to incise the transversalis fascia, subserous connective tissue, and peritoneum, or the entire structures comprising the posterior wall of the inguinal canal, and intervening between the latter and the peritoneal cavity, and to divert the cord from its course in front of the transversalis fascia to a similar course behind the peritoneum and within the cavity of the latter.

The method finally adopted and herewith presented permits of complete obliteration of the internal ring and inguinal canal, and disposes of the cord so far as its relations to these are concerned, quite as effectively as castration itself can do. In addition to this, its employment admits of the correction of the relaxed state of the fascia at the site of Hesselbach's triangle, so often present in old indirect hernias, and one of the predisposing causes of direct inguinal hernia as well. It consists essentially of the transplacement of the spermatic cord immediately behind the peritoneum and into the peritoneal cavity for the distance represented by the space extending from the site of the internal ring to the lowermost reflection of the peritoneal investment of the abdominal wall behind the horizontal ramus of the pubes.

The operation in detail is as follows: The patient is placed in the Trendelenburg position, in order that the presence of the intestines may not embarrass the operator in the steps of the operation subsequent to the opening and emptying of the hernial sac. The incision commences at the spine of the pubis, is carried parallel with the os pubis for about an inch, and is then curved obliquely outward and upward upon the line which marks the general direction of Poupart's ligament, until a point is reached corresponding to the level of the internal ring. (Fig. 1.) Skin, fat, and fascia to the aponeurosis of the external oblique are included in the incision. The curved flap thus marked out is reflected, when the entire

region involved in inguinal hernia, including the inguinal or spermatic canal, as well as the site of Hesselbach's triangle, is exposed to view. (Fig. 2.) The anterior wall of the canal is now split up to the site of the internal ring. The cord and sac are first isolated together, the isolation commencing at the pubic bone, where the cord is usually easily identified and separated. These structures are next separated from each other, each being traced to the internal ring and thoroughly isolated from all structures in the neighborhood. (Fig. 3.)

The hernial sac is now opened, its contents reduced if reduction has not already occurred, and the sac cut away to the level of the muscular layer of the abdominal wall. Its incised edges are grasped by forceps to prevent these from slipping away. The cord being held out of the way, the place of crossing of the deep epigastric artery upon the transversalis fascia is sought, and both the artery and vein isolated and ligated in two places and divided between the ligatures. (Fig. 4.) The index-finger is now introduced into the peritoneal cavity through the neck of the sac, and the posterior wall of the canal, as well as the site of Hesselbach's triangle, lifted up upon the palmar surface of the finger. With the latter as a guide the entire intervening structures are divided with the scissors, the division including, from without inward, the transversalis fascia, the subperitoneal connective tissue, and the peritoneum. (Fig. 5.)

The spermatic cord is now placed into the peritoneal cavity; the gap in the incised posterior wall of the inguinal canal is held apart by grasping the incised peritoneal edges with forceps. In those instances in which the internal ring is greatly enlarged in all directions and a large neck to the hernial sac exists, a slit may be made in the edge of the latter towards Poupart's ligament, in order to lead the cord easily to the peritoneal cavity. (Fig. 6.) The edges of the opening are now drawn forward so that a broad approximation of their serous surfaces is obtained. While held in this position through-and-through sutures are passed from side

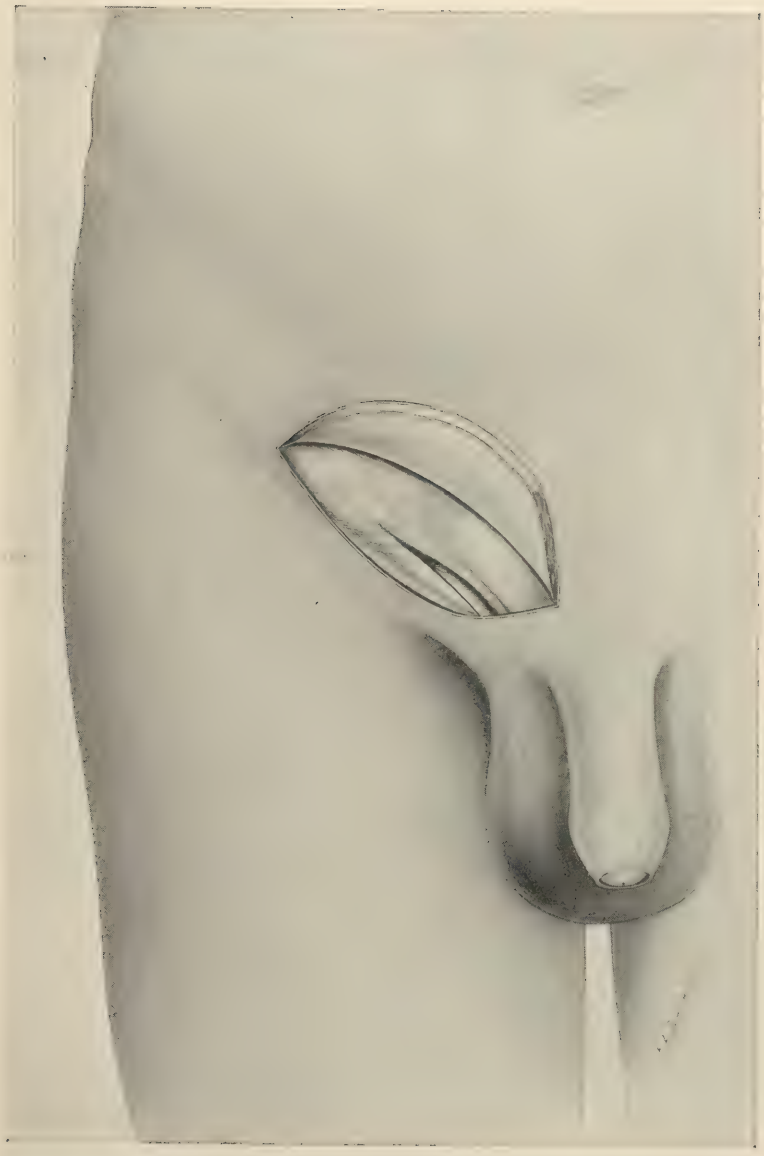


FIG. 2.—Flap turned back, showing aponeurosis of external oblique, external ring, and cord as it passes over pubic bone.

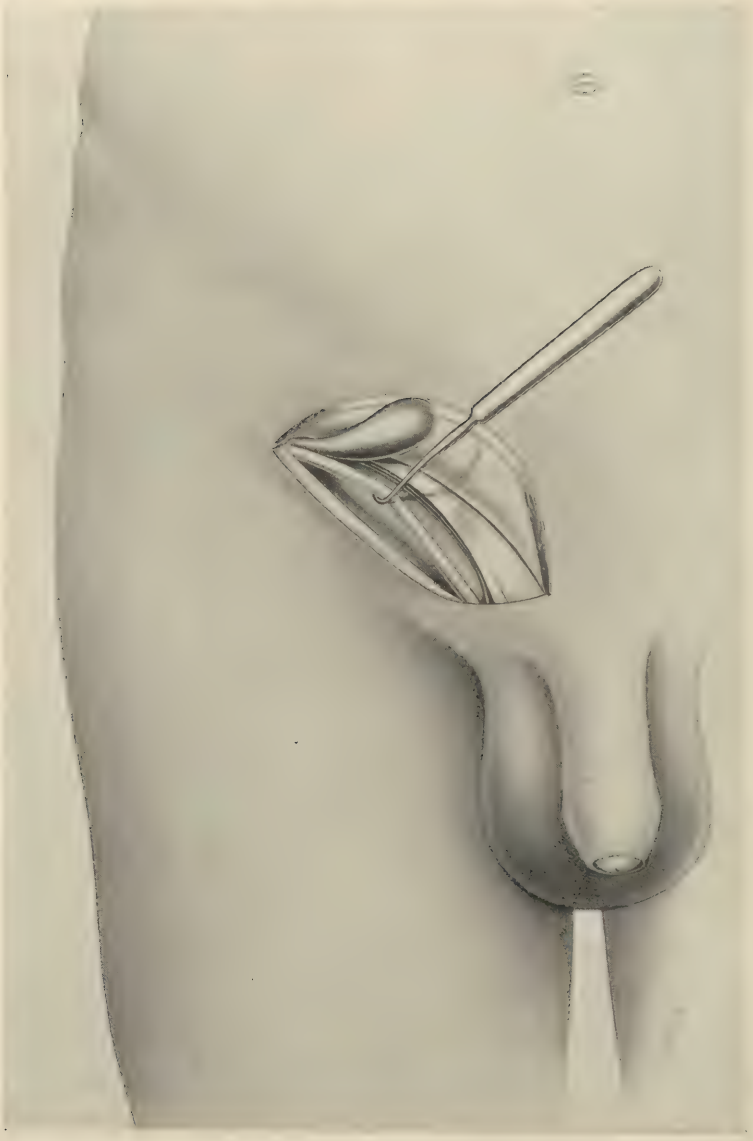


FIG. 3.—Inguinal canal opened up from external to internal ring, showing hernial sac and cord isolated.

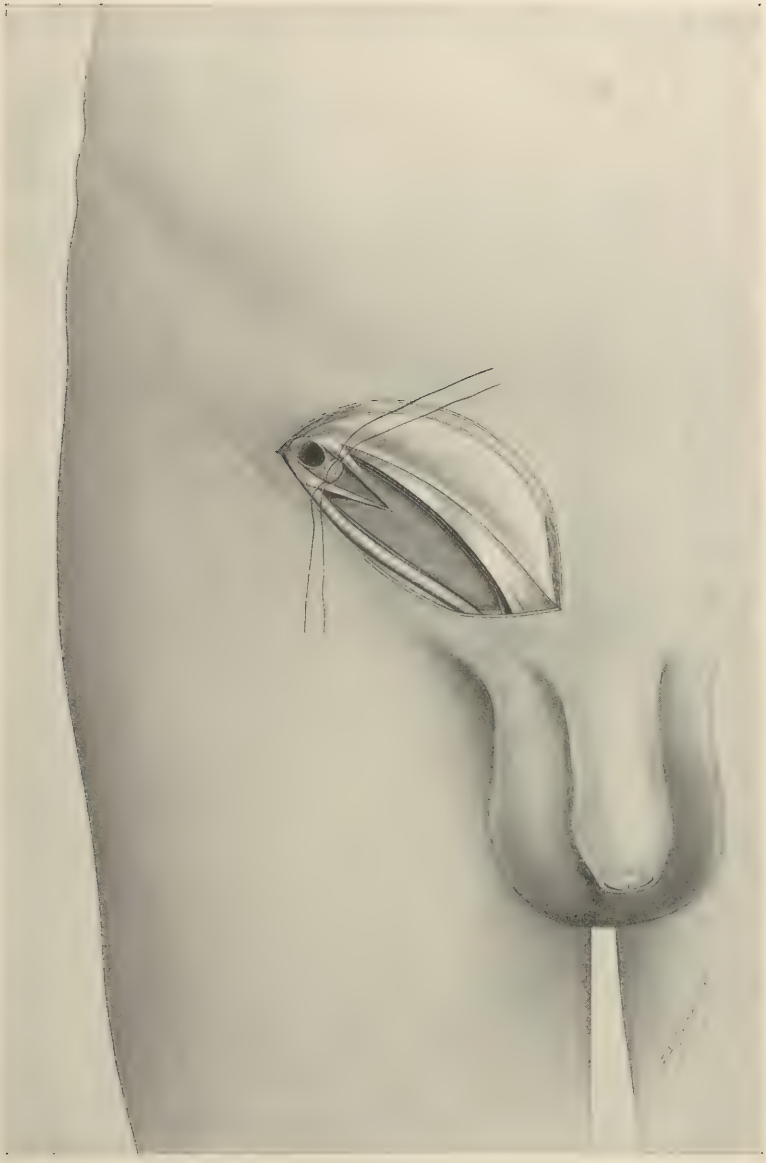


FIG. 4.—Hernial sac cut away, transversalis fascia opened, exposing deep epigastric vessels ligated in two places.

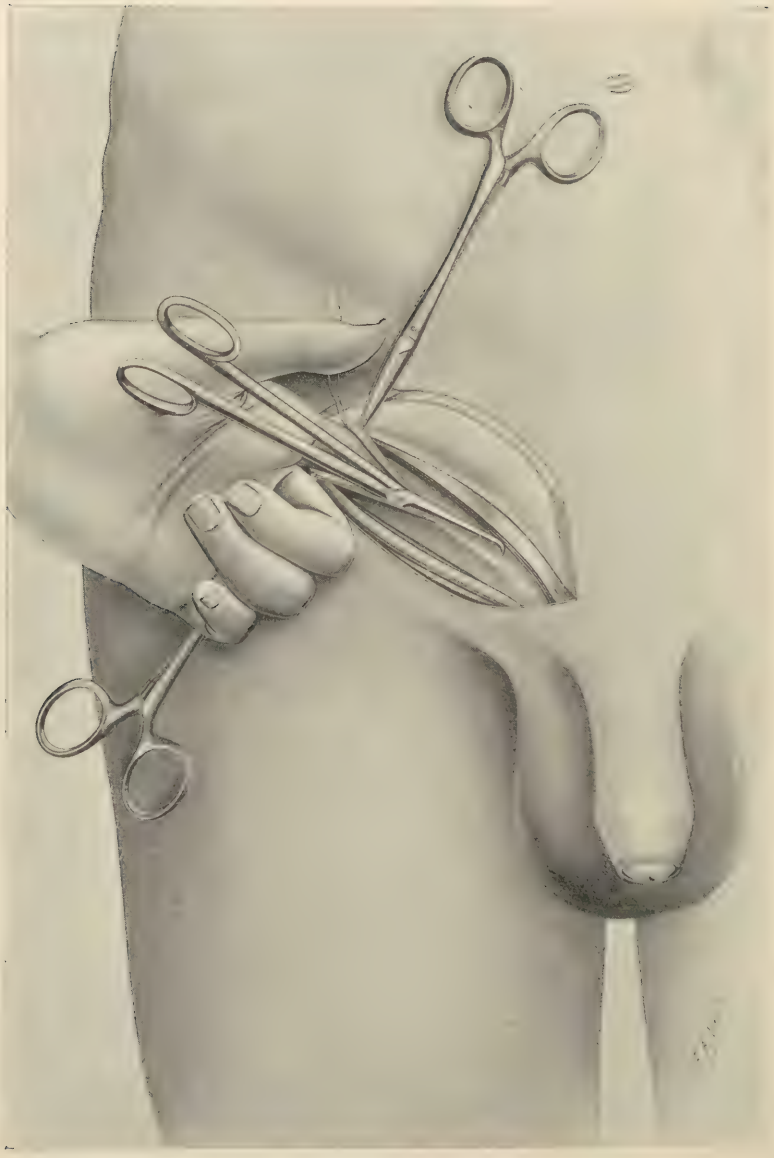


FIG. 5.—Incision of posterior wall of inguinal canal.

to side. By this manœuvre any existing relaxed state of this portion of the transversalis fascia is corrected.

The suture is first passed above the site of the internal ring, and includes the transversalis fascia, which is drawn downward and forward for that purpose. This serves to cover the point where the cord passes into the peritoneal cavity at the site of the internal ring, thereby obliterating the latter, the cord itself filling the small opening in the peritoneum. The position of the cord upon the peritoneal surface of the abdominal wall is such as to act as a "shunt," carrying any intestine in the neighborhood away from rather than towards the original weak point.

The suturing is continued until the lower angle of the

FIG. 6.—Illustrating the placing of the cord in the peritoneal cavity. Slit in sac.

gap in the posterior wall of the original inguinal canal is almost reached. This angle should be made low enough to compel the cord to curve slightly upward and forward as it leaves its place of exit from the peritoneal cavity at the newly formed external ring. (Fig. 7.) The cord should rest easily in the angle, and the suturing stop short of constricting it therein.

The inguinal canal, including the gap in the aponeurosis of the external oblique which represents the external ring and the skin wound are now to be closed. In effecting this the choice of material lies between absorbable sutures, such as animal tendon, catgut, etc., and non-absorbable sutures

applied so as to be *easily removable*. The fact that I have been called upon to remove suture material of the latter class, when buried in the tissues, at periods varying from three months to three years from the original operation, has led me to agree with Coley in discarding this class of sutures, in hernia cases at least. The uncertainty of the chromicizing process, as at present applied in the preparation of catgut, is such as to greatly impair my confidence in this as a suture material. There appears to be great difficulty in striking the exact balance between the cell-activity of the individual, upon the one hand, and the restraining influence of the chromic acid in preventing the disintegration of the catgut, upon the other. Simple unhardened catgut certainly breaks down too rapidly to be of service unaided. The recently introduced formalin gut may solve the problem, so far as the use of this as suture material for hernia cases is concerned.

The use of kangaroo tendon, introduced by Marcy, of Boston, as a hernia suture, has been attended with a large measure of success in closing the canal in the hands of Coley, of New York, following Bassini's method of radical cure in hernia. It does not appear to be open to the same objections as catgut, inasmuch as it will last sufficiently long, providing suppuration does not take place in the wound, to insure firm union of the structures before its final disintegration takes place. In some instances the tendon seems to serve as the basis for a definitely organized and firm connective tissue proliferation, which replaces the tendon and aids most efficiently in the final consolidation of the parts originally concerned in the suturing.[3]

The canal sutures include the conjoined tendon and aponeurosis of the external oblique upon the inner margin, and Poupart's ligament upon the outer. The two lower sutures should include the outer edge of the pyramidalis, if this be present, and if not, the rectus muscle. The effect of this is to displace a portion of the muscular tissue to a situation to guard the point of exit of the spermatic cord. A continuous suture is now applied to secure more accurate

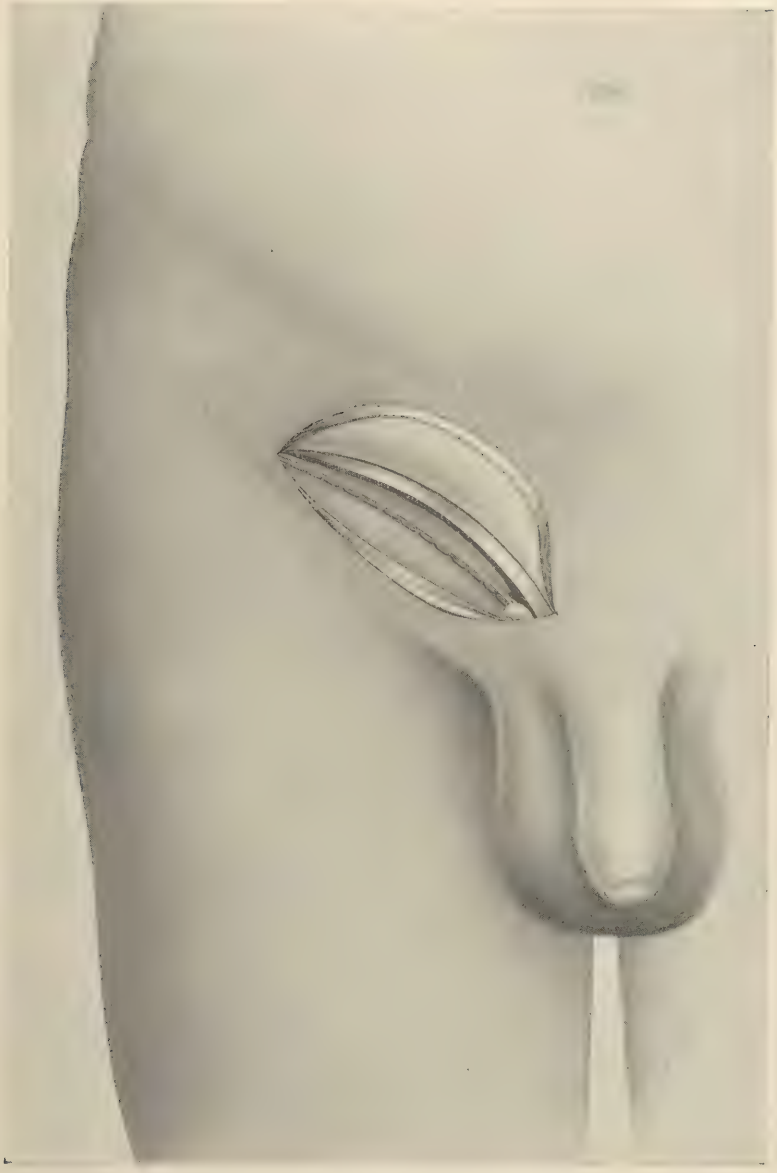


FIG. 7.—Posterior wall of inguinal canal restored.

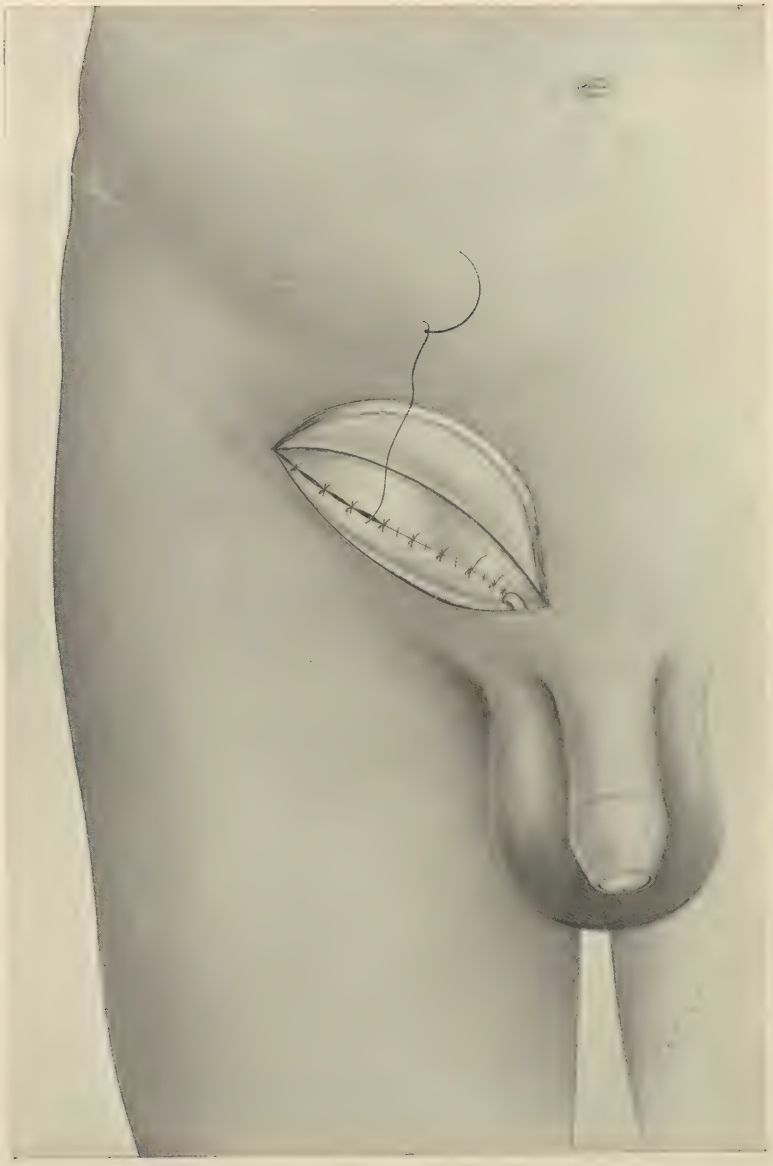


FIG. 8.—Obliteration of inguinal canal.

coaptation of the margins of the aponeurosis of the external oblique, the turns of the suture passing in the spaces between the interrupted sutures. (Fig. 8.)

The skin wound is closed by a subcuticular or other appropriate suture and proper sterile dressings applied.

I have operated upon six hernias, in five cases by this method, the histories of which are briefly as follows:

Case I.—A young man, of nineteen years, entered the Methodist Episcopal Hospital on April 24, 1897, with a right-sided, indirect inguinal hernia. The operation revealed a hernia into the funicular process. The vessels of the cord were enlarged. The operation of intraperitoneal transplacement of the cord, obliteration of the internal ring and inguinal canal, and displacement of the rectus to strengthen the site of Hesselbach's triangle, was done as above described. In addition to this a ribbon-shaped portion of the sac was preserved and utilized to form a loose loop or sling for the cord within the cavity of the peritoneum. The patient walked about on the fourteenth day following the operation. Some disturbance of the circulation in the cord and testicle was experienced. Upon being discharged from the hospital he was enjoined not to wear a truss, and promised a monetary reward if he ever presented himself with a recurrence of the hernia.

The disturbance of the circulation in the testicle, in this case, was the result either of the removal of too many of the veins of the cord or the looping up of the cord by the ribbon-shaped band of peritoneum alluded to. In any event, the former is generally and the latter always unnecessary.

Case II.—A boy, of ten years, was admitted to the Brooklyn Hospital on April 27, 1897, with an indirect, inguinal hernia, which had existed since birth. The operation revealed a hernial sac extending to the head of the epididymis. The cord was transplaced into the peritoneal cavity, the internal ring and inguinal canal obliterated, and the lower portion of the rectus displaced so as to strengthen the site of Hesselbach's triangle and the newly formed external ring. The recovery was uneventful, the patient leaving his bed on the fourteenth day.

Case III.—A man, of twenty-six years, with an acquired,

indirect, inguinal hernia of six years' standing, finding himself unable to retain his rupture with the amount of truss-pressure that he was able to bear comfortably, applied at the Brooklyn Hospital for treatment. The operation of intraperitoneal transplacement of the cord, typical obliteration of the internal ring and inguinal canal, and displacement of the rectus was performed, as described. The patient was allowed to walk in fourteen days, enjoined to avoid wearing a truss, and promised remuneration if he ever presented himself to me with a recurrence of the hernia.

Case IV.—A child, of three years, was admitted to the Bushwick Hospital with large, double, scrotal hernia. Both hernias were operated upon at one sitting on May 21, 1897, after the manner described, and the child secured in a double plaster-of-Paris spica. Primary healing took place. He was permitted to play about upon the fourteenth day, and was discharged from the hospital cured.

Case V.—A man, of thirty-seven years, was admitted to the Brooklyn Hospital on May 31, suffering from strangulated scrotal hernia. The hernia had existed since childhood, and he wore a truss for several years. This he discarded, and for at least ten years the hernia had been unreduced. In this case the posterior wall of the inguinal canal and the site of Hesselbach's triangle was so stretched and distorted that it became necessary to make an unusually broad approximation at this point, in order to effect restoration of the normal condition of the parts. Infection of the parts took place from the contents of the sac, and I was finally compelled to drain the angles of the superficial wound, thus somewhat prolonging the convalescence.

The following additional case was operated upon in my service by Dr. R. S. Fowler, one of my assistants:

E. S., nineteen years old; German; admitted to the Brooklyn Hospital June 30, 1897; discharged July 16, 1897; congenital inguinal hernia, left side. Used a truss until twelve years old, since then nothing. Pained him on lifting weights, etc. Easily reducible. Operation July 1, 1897. Method as described. Primary union. Uninterrupted recovery. Patient left bed on fourteenth day and hospital two days later.

In reply to the criticism that the cases presented are too

few as well as recent to be of service in estimating the value of the new procedure, I would say that they are presented with the view of demonstrating that the obliteration of the internal ring and inguinal canal is possible without resorting to castration, the most efficient of the formerly practised methods of radical cure of inguinal hernia. This is made possible by the method of intraperitoneal transplacement described. The cord in its new position lies in close approximation to the line of suturing of the peritoneal surfaces. Adhesions occurring under these circumstances would be located similarly to those following an ordinary abdominal section, and as little likely to do harm as the latter.

As far as I have been able to ascertain from the experiences of other surgeons in the instances in which recurrence has taken place following the various methods of displacing the cord anteriorly, as in the operation of Bassini and its modifications, the course pursued by the hernia has been directly forward, following the cord in its course through the muscular wall of the abdomen.

In answer to the objection that the formation of a new external ring, made necessary in order to permit the cord to emerge from the peritoneal cavity, may lead to a recurrence of the hernia at this point, I would call attention to the fact that the new ring is so placed as to rest upon and somewhat posteriorly to the pubis. This is accomplished by terminating the incision through the transversalis fascia and peritoneum as low down as possible, the cord emerging from the new opening in such a manner that its first course is upward and forward before passing over the bone. (Fig. 9.) In addition to this the outer edge of the rectus muscle is carried outward by suturing, in order to strengthen Hesselbach's triangle, as well as the final place of emergence of the cord. Further, an osteoplastic transplantation of the pubic attachment of the rectus may be accomplished by chiselling away a portion of the bony attachment of the muscle. The latter would rarely become necessary.

A brief recapitulation of the steps of the operation would include the following:

(1) A curved skin incision which furnishes easy access to all the parts involved in inguinal hernia.

(2) Splitting the anterior wall of the inguinal canal from the external to the internal ring.

(3) Isolation of the cord and sac together from the surrounding parts, after which these are separated from each other and cleared well up to the internal ring.

(4) Double ligature of the deep epigastric artery, with sufficient space between the ligatures to permit of incision.

(5) Cutting away of the neck of the sac and incision of

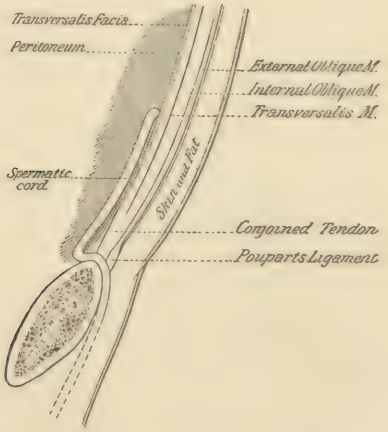


FIG. 9.—Showing new position of the cord.

the posterior wall of the inguinal canal and Hesselbach's triangle.

(6) The cord is transplaced into the peritoneal cavity from the site of the internal ring to a point below the level of the pubic bone.

(7) Broad approximation and suturing of the peritoneum and transversalis fascia in front of the cord for the space mentioned.

(8) Obliteration of the internal ring and inguinal canal by accurate suturing, and strengthening of Hesselbach's triangle and the new point of emergence of the cord by outward

displacement of the pubic attachment of the corresponding rectus muscle.

REFERENCES.

[1] Ueber die Behandlung des Leistenbrüche, Archiv für klinische Chirurgie, Band XL, p. 429.

[2] Transactions of the Tenth International Medical Congress, Vol. III, p. 186.

[3] The expense attending the procuring and preparation of kangaroo tendon has heretofore limited its use somewhat. It can now be obtained, put up in hermetically sealed "U"-shaped tubes, introduced by the writer several years ago for the sterilization and storage of ligature and suture material. The sterilization is completed after the tube is sealed. See Transactions of the American Surgical Association, Vol. IX, 1891, p. 485.